form L736

bird®
corporation

bird®

respirator / MARK 7 • MARK 8 • MARK 10 • MARK 14

repair / manual

introduction

The bird respirators have been designed to provide the maximum amount of utilization with a minimum of maintenance. There will be a time, however, when the bird respirator should receive maintenance attention. This pamphlet will provide the information necessary to correctly disassemble and reassemble a bird MARK 7®, MARK 8®, MARK 10® or MARK 14.

Since the bird MARK 8, MARK 10, and MARK 14 respirators use the MARK 7 design as a primary component, the disassembly and reassembly instructions will refer to the MARK 7 only. Further information regarding the other models is found in the supplementary instructions.

Before beginning disassembly, please refer to the trouble-shooting section. Several simple testing procedures are described and are helpful in testing all bird respirators periodically. Often, the exact cause of trouble or malfunction can be determined before disassembly.

To properly service the bird respirators a service man's tool kit 079 is recommended. Also a respirator repair kit 2200 which includes a selection of all parts normally required for routine maintenance and repair is suggested. Other items of interest may be found in the new bird catalog.

Special training regarding all bird respirators is available at the bird Institute Seminars in Palm Springs, California. These Seminars are conducted on a no charge basis and are open to any qualified person. Further information may be obtained by writing bird Corporation, MARK 7 Respirator Lane, Palm Springs, California, 92262.

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index

trouble shooting 4

disassembly instructions 6

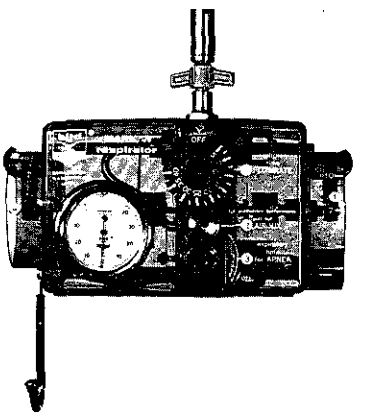
reassembly instructions 8

respirator calibration 11

MARK 8 supplementary instructions 12

MARK 10 and 14 supplementary instructions 13

special bird tool kit and repair kit 15



trouble shooting

Designed with a minimum of moving parts, the bird respirators experience few problems and these may be broadly categorized as follows:

1. **Contamination from the respirator gas supply.**
2. **Contamination from medications dripped back into the unit.**
3. **Dropping or otherwise mishandling the unit.**
4. **Aging of lubricants and O-rings.**

Probably the most frequent cause of malfunction is the contamination of the respirator from its gas supply source. Although designed with an inlet filter, water and particles less than 5 microns in size are not retained by this filter. The tolerances in the ceramic (on-off) switch are such that the slightest amount of water will cause its action to be sluggish and insensitive. The following symptoms are typical of this problem.

1. **The action of the ceramic switch may be sluggish and the unit insensitive to patient's inspiratory effort. As a result the calibration of the respirator is off.**
2. **The ceramic switch may be frozen in position from the residue of dried moisture.**
3. **Flow from the respirator may be low because of a partially blocked inlet filter or an occluded venturi jet.**
4. **The expiratory timer system may not function properly because of corrosion of the cartridge parts caused by water.**

If this type of contamination is suspected, inspect the pressure compartment in the area of the venturi gate. Frequenty this area is clouded from water residue. This problem will require a complete disassembly, cleaning and reassembly.

Medications dripped back into the respirator are also a frequent problem, although much less harmful than a contaminated gas supply. Malfunction of the respirator manometer is common to this problem. Normally, a partial disassembly, cleaning and sterilization is all that is required to correct this problem. However, always be extremely cautious when the unit is not disassembled completely. Potential problems may remain hidden.

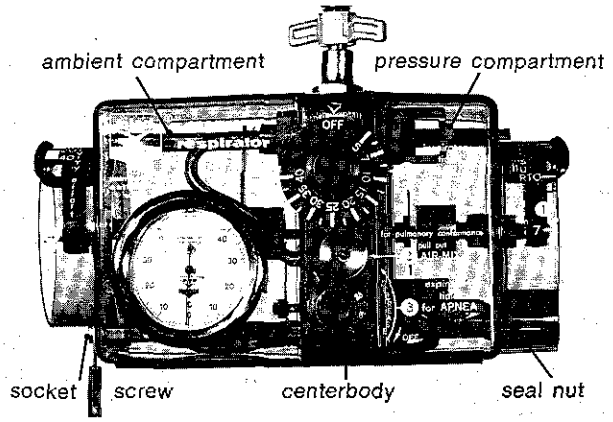
If the unit has been dropped or otherwise mishandled the results are usually readily visible. Normally, replacement of the defective parts and recalibration are all that is necessary to restore the unit to normal operation.

The materials which have been chosen for the construction of the bird respirators are extremely durable. However, after a long period of time, five years or more, the O-rings and the lubricants may reach a point where they no longer perform their function properly. If this is a suspected problem, the unit should be torn down completely, cleaned and reassembled.

A few simple tests may be performed on the respirator in order to determine some of its performance characteristics. First, to determine the cleanliness of the ceramic switch, attach the unit to a 50 psi gas supply. Attach a complete breathing hose 133 but remove the mouthpiece. Set the pressure limit at the minimum possible, set the sensitivity control to the minimum possible (counterclockwise) also, open flowrate control to maximum, pull air-mix knob out and turn expiratory timer control off. If the ceramic switch is clean, the respirator should now cycle rapidly. This test may also be performed after reassembly of the repaired respirator to test the quality of the work. When testing the bird MARK 10 and MARK 14 in this manner note that they will not chatter as rapidly as a MARK 7 or MARK 8.

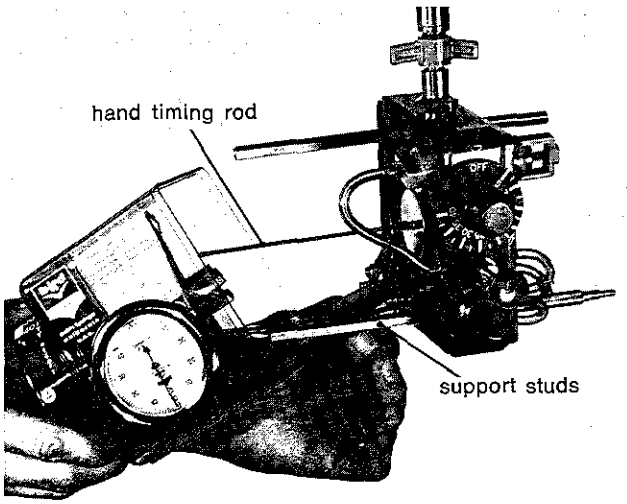
To test for adequate flow, remove the breathing hose from the unit and plug the mainstream respirator outlet with a 916 stopper. Increase the pressure setting until the magnet contacts the armature plate. Pull the air-mix knob out, turn expiratory timer control off, set flowrate knob to maximum and observe maximum pressure on the respirator manometer. On a MARK 7 or MARK 8 this pressure should exceed 35 cm H_2O and stabilize within the green area. If the pressure does not reach this limit, the flow may be inadequate or there may be a gas leak out of the pressure compartment. If the pressure does not stabilize and continues to rise there is a leak of high pressure gas into the compartmen. This could possibly be a leak from the expiratory timer system or the ceramic switch O-rings. This test should not be done on a MARK 10 with the flow accelerator on as the pressures will exceed 70 mm Hg and the manometer may be damaged. If this test is done on a MARK 14, with the accelerator "on" the minimum pressure should be 70 mm Hg.

disassembly



1 • Remove socket screw and seal nut and draw off pressure compartment. Remove compartment O-ring seal.

2 • Remove socket screws and carefully draw ambient compartment back *until the hand timing rod clears the magnet.* Remove manometer hose from center body fitting.

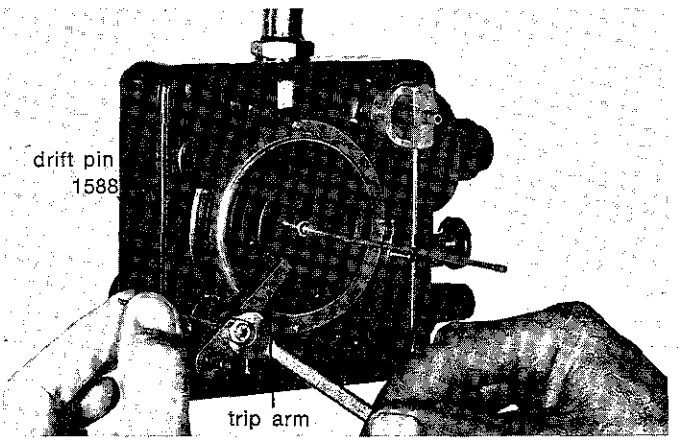


3 • Remove all hose clips and tubing from serrated fittings. NOTE: The tubing should not be re-used and may be cut off if desired.

4 • Remove compartment support studs.

5 • Venturi gate cage is hand tight and may be removed. Withdraw venturi and jet cage assembly. Remove and inspect jet before cleaning. The jet may be cleaned with the stylet, 924, if occluded.

6 • There are various methods by which the expiratory timer trip arm may be mounted on the cartridge shaft. Remove the trip arm from the cartridge shaft in the appropriate manner. Note the washer behind the trip arm. Carefully remove the Truarc retaining ring and withdraw cartridge from the center body. Disassemble the cartridge by unscrewing the two halves to expose the diaphragm. Remove the retaining ring and end plug from the cartridge body. Note the O-ring seal is lubricated, *however the O-ring which forms the gate seat should be clean and dry.*

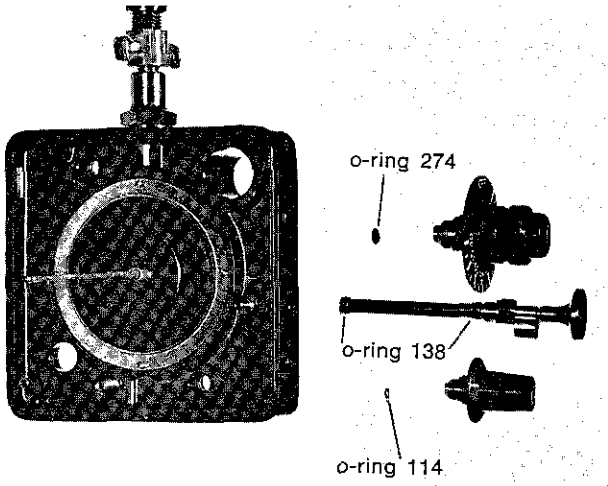


Remove lock nut from expiratory timer shaft while holding shaft from turning with drift pin.

7 • Open flowrate control and use a thin 5/8" open end wrench to remove valve from center body.

8 • Open expiratory timer control valve and remove from center body. *Use care not to lose the small O-ring seal* on the end of the valve.

9 • Remove air mix control from center body using 7/16" open end wrench.

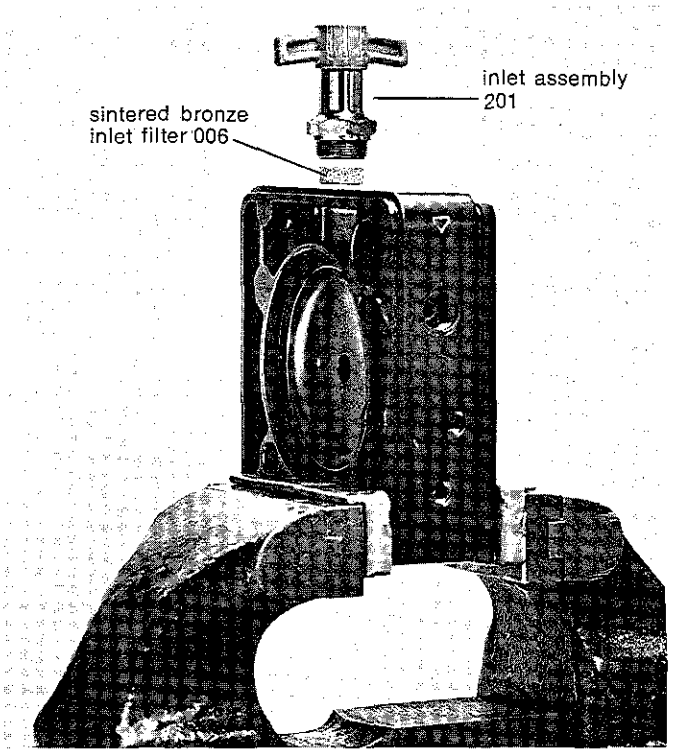


10 • Remove all serrated nipples from center body using 5/16" nut driver or deep socket.

11 • Remove 4 screws retaining the diaphragm ring. Remove safety wire and hand timer shaft lock nut. To prevent the shaft from turning use a needle nose plier to hold the flat portion of the ambient side. Remove pressure compartment armature plate and note O-ring bumper. Carefully withdraw the hand timer shaft, sensitivity armature plate, diaphragm assembly and spacer without disturbing the ceramic spindle.

12 • Carefully remove the ceramic spindle, remove the Truarc retaining ring and press out the ceramic bushing from the ambient side using the special tool 031 which is included in the tool kit 079. *Never utilize any other type of device.* Be sure that all 3 O-rings on the ceramic bushing are removed from the center body and discarded.

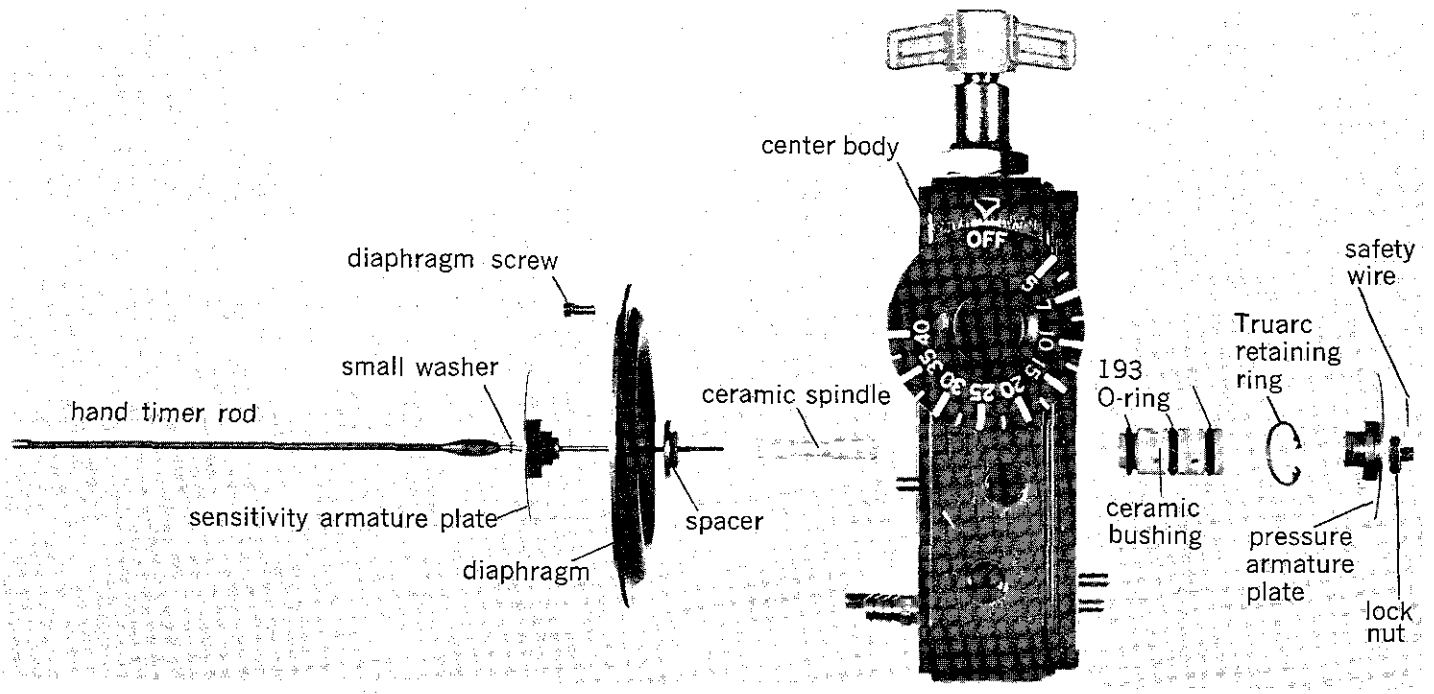
13 • Place the center body in a vise with padded jaws and remove the inlet assembly . . . and then remove the inlet filter. NOTE: In extreme circumstances the sintered bronze inlet filter may be severely corroded and not easily removed. We recommend that a hole be drilled in the inlet filter and a self-tapping screw inserted in order to provide enough leverage to remove the filter. *Do not attempt to use a screwdriver around the outside of the filter to remove it, as the threads in the center-body will be damaged.*



14 • The ambient and pressure compartments may be completely disassembled.

15 • The components of the respirator may now be soaked in a germicidal detergent. We recommend approx. 30 minutes in a solution of 4 to 6 ozs. SK 30* per gal. of water. The temperature of the water should not be more than lukewarm. After soaking, parts should be removed, rinsed and scrubbed, if necessary, to remove all traces of thread sealant and lubricant. Use an Ajax type cleaner sparingly with a toothbrush and bottle brushes where necessary. Particular attention should be paid to the ceramic switch. The clearance between the spindle and bushing is normally about 0.0001". . . these contacting surfaces should be thoroughly cleaned and rinsed in distilled water if available, and blown dry with clean compressed air. *The shoulders of the spindle should not be handled in any way once cleaned to prevent contamination.* Clean, dry compressed air should be used to dry all drill passages in the center body . . . be sure that the screw plug in the bottom center of the center body is removed for cleaning and drying.

*Easterday Supply Company Los Angeles, California



reassembly

1 • Install a new 006 inlet filter and tighten the inlet assembly until it bottoms out.

2 • *Install 3 new 193 O-ring seals on the ceramic* bushing. CAUTION: **Do not re-use** the old O-rings. Lightly moisten the O-rings with water and install the ceramic bushing into the center body. Install the Truarc retaining ring and insert ceramic spindle carefully into the bushing, *making sure that the long shoulder of the spindle is on the pressure compartment side.*

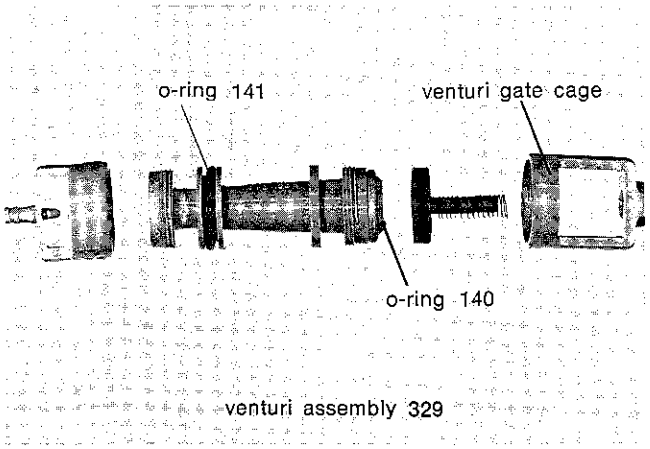
3 • Install flowrate valve after checking the 274 O-ring for flat spots or cuts. Use Rector Seal* No. 15 as a thread sealant. CAUTION: **Never use any thread compounds which are not approved for high pressure oxygen environments.** Check the calibration of the flowrate valve by turning the valve "off." The middle letter "f" in off should line up with the index on the center body.

4 • Place the thumb and middle finger at either end of the ceramic switch spindle and turn the air supply to the center body "on." The function of the ceramic switch may be checked by moving the spindle to the "on" and "off" positions. The spindle should move easily and be free of binding. *Be careful not to release the spindle with the air supply on, as it is possible to blow the spindle out of the bushing.*

5 • *Install the small washer, sensitivity armature plate,* diaphragm and spacer onto the hand timer rod shaft. Carefully insert the shaft into the ceramic switch spindle. Install pressure armature plate with bumper O-ring and lock nut. *Carefully tighten the lock nut until* there is zero end play in the shaft assembly. Neatly install safety lock wire.

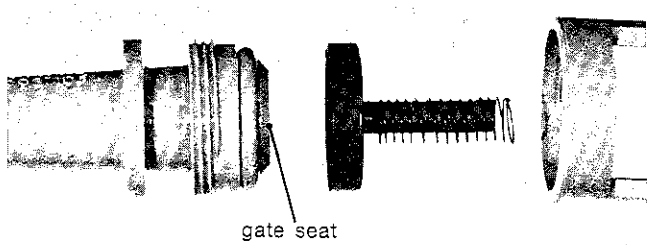
*Rector Well Equipment Co., Inc. — Houston 2, Texas

6 • Align the diaphragm ring and insert the 4 diaphragm screws. Use extreme caution, *do not overtighten these screws.* Again check freedom of play of the ceramic switch assembly.

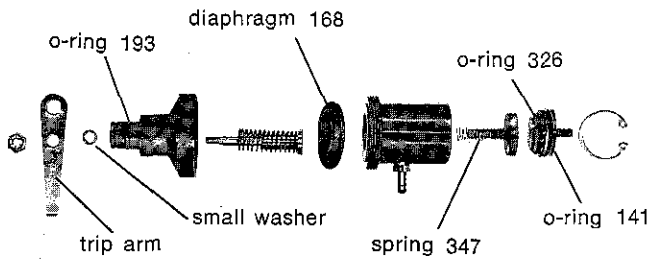


venturi assembly 329

7 • Check the venturi jet to be free of obstruction and hand tighten the jet cage onto the venturi body. Smear a single drop of lubricant, 631, on the center O-ring of the venturi body. *Check that the gate O-ring seat is clean and dry.* Install the venturi body in the center body. Before installing venturi gate check the gate spring length. It should be the same length as the gate shaft. Carefully compress or stretch spring if necessary. Screw the gate-cage assembly onto the venturi body until the cage is vertical and the end of the gate shaft is flush with the end of the cage. This guarantees proper spring tension.

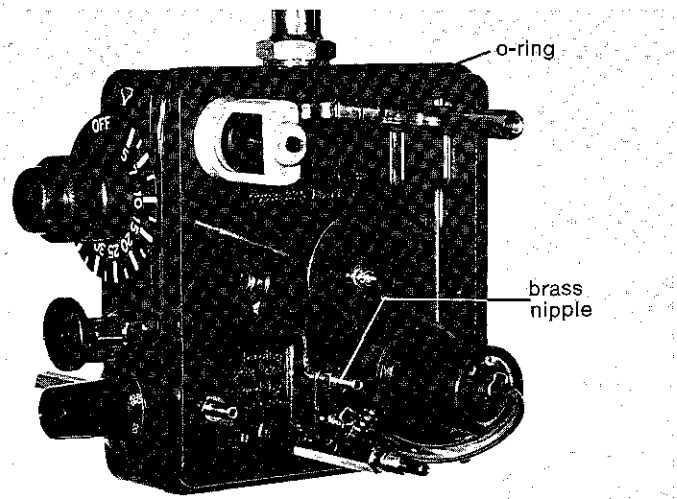


8 • Smear a drop of lubricant on the 193 O-ring on the expiratory timer cartridge and install in center body. The bowed retaining ring should be reinstalled with the stamped lettering facing outwards. Re-install the trip arm. Refer to exploded view of cartridge assembly for proper assembly sequence.



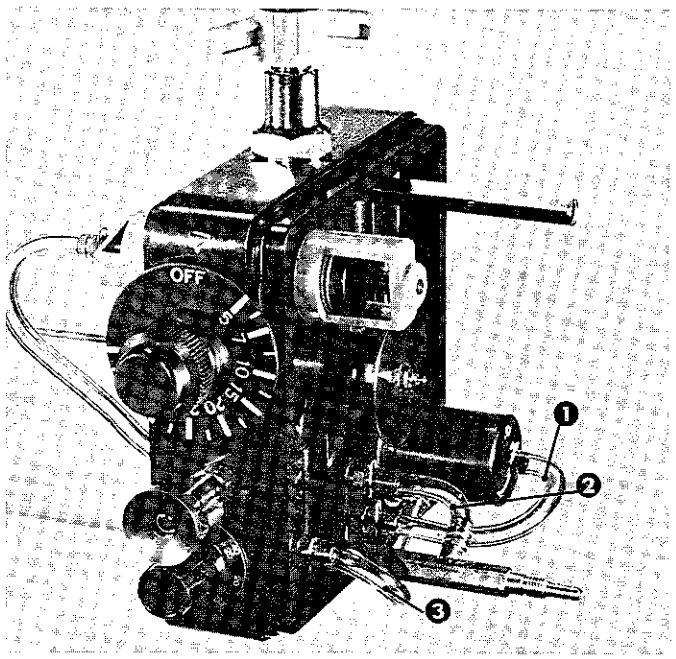
expiratory timer cartridge 216

9 • Place a drop of lubricant 631 on the two (2) 138 O-rings on the air mix rod. Install in center body. Check the 114 O-ring on the expiratory timer valve for flat spots or cuts and carefully re-install valve in center body.



10 • Re-install all serrated nipples. *Note the position of the brass ⅛" nipple with orifice.* Install compartment studs.

11 • Cut new tubing to proper lengths and install as illustrated. NOTE: **The hard 1/8" ID PVC tubing should always be used.** Never use the soft .105 ID tubing. Install hose clips oriented in a horizontal position.



1. expiratory timer fill line 1/8 x 2 1/2"
2. micronebulizer powerline 1/8 x 2"
3. expiratory timer bleed line 1/8 x 4"
4. venturi drive line 1/8 x 4 1/2"

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12 • Reassemble pressure compartment if necessary. Inspect pressure compartment O-ring seal for flat spots, cuts, etc. and install seal on center body. Moisten the O-ring seal with a soap solution* and install the pressure compartment on the center body. Slowly tighten the seal nut and socket screw to avoid kinking the gasket between the pressure compartment and the center body.

*A weak mixture of Joy detergent and water will not harm plastic parts.

13 • Soap test the main diaphragm for leaks using the following method. Pull air mix knob out, turn flowrate knob to maximum, plug mainstream outlet of pressure compartment, turn inlet gas supply "on" and hold ceramic switch in "on" position. Pressure is now built up in the pressure compartment and a soap test for leakage around the pressure compartment O-ring, pressure magnet shaft and main diaphragm may be made.

14 • The ambient compartment may be reassembled... use a new 123 ambient filter. Note on the rear of the manometer the small screw in the 12 o'clock position. This is the zero adjustment screw. However, do not attempt zero adjustment until the manometer is mounted in the compartment. Attach manometer tubing to center body and carefully install ambient compartment. **Use caution with the hand timing rod** and be sure the magnet yoke is properly fitted over the compartment studs. The unit is now completely assembled and ready for calibration.

see bird form L715

calibration

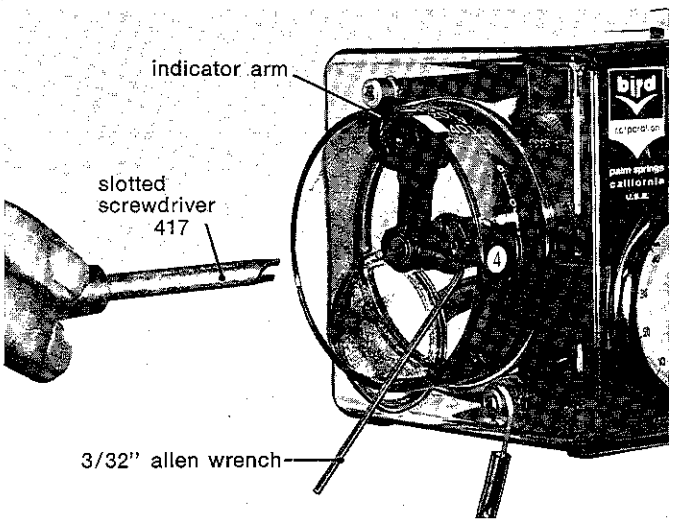
1 • Loosen the set screws on the pressure and sensitivity indicator arms. The magnets may now be rotated within the indicator arm assembly. NOTE: **Use only the special 417 slotted screwdriver for adjusting the sensitivity magnet.** Attach a breathing circle 133 with a 409 test lung to the respirator and turn the inlet gas supply "on." Set the flowrate knob to "5." Back both the pressure and ambient magnet out to their farthest position from the centerbody. Slowly screw the pressure magnet in until the respirator begins to cycle. Adjust the magnet so the respirator cycles to the "off" position at 15cm H_2O as indicated on the pressure manometer.

2 • Be sure that the expiratory timer valve is closed and see that the trip arm is not triggering the respirator on. If the respirator is auto-cycling, slowly turn the sensitivity magnet inwards until it just holds the respirator in the "off" position. Adjust the sensitivity magnet so that the respirator switches at a -1.5cm H_2O. This negative pressure may be generated by sipping slowly on a mouthpiece in place of the test lung. Align both indicator arms on 15 without disturbing the magnets and tighten the set screws. Recheck the sensitivity and pressure calibration.

3 • Check the function of the expiratory timer system by observing the trip arm.* Remove the valve knob and adjust the valve stem with a needle nose pliers for an expiratory time of 3 seconds. Re-install valve knob with 15/10 aligned with the index.

*Clearance between the trip arm and armature plate when the cartridge is pressurized and the ceramic switch in the "off" position should be ⅛". This may be adjusted by bending trip arm.

4 • Check the function of the air mix and flowrate control knob and the repeatability of pressure and sensitivity settings. When rotating flowrate control from "off" through 40, there should be a smooth, gradual increase in flow with a sudden increase beyond 40. Pushing the air mix control knob "in" should cut out the venturi action and this may be observed by watching the venturi gate . . . and audibly monitoring a decrease in flow. With the inlet pressure "on" and settings of 15-15-15 and the auto-timer "on" allow the respirator to cycle for one hour with a test balloon. After this time recheck control functions and pressure and sensitivity calibrations.



Loosen set screws on the indicator arm with allen wrench and adjust sensitivity magnet. Use only the special slotted screwdriver 417 supplied with tool kit.

MARK 8

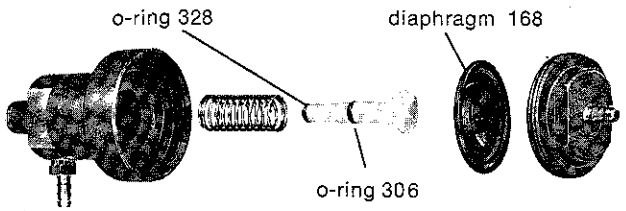
respirator supplementary instructions

The bird MARK 8 differs from the MARK 7 in that it has the ability to create a negative phase during the patient's exhalation. It is therefore classified as a positive/negative phase respirator. It is easily identified by the red anodized center body and the markings on the ambient compartment.

To generate a negative pressure at the patient connection, the MARK 8 itself provides an adjustable source of flow to a negative pressure venturi located within the breathing circle. The control valve is called the negative pressure generator and is located directly behind the inlet assembly. An additional cartridge 302, located in the ambient compartment, interrupts this flow during inspiration so that the inspiratory flow pattern is not altered from that of a MARK 7.

With the ceramic switch in the off position and the respirator gas supply on, rotate the negative pressure generator valve to determine that there is a smooth increase in flow throughout the control range and that the valve is capable of shutting off this flow entirely. Set the valve approximately one-half turn open and determine that the negative generating flow is indeed interrupted during the inspiratory cycle by manually cycling the ceramic switch on and off rapidly. This flow should start and stop cleanly, with no perceptible time lag. If this action is sluggish, the cartridge requires attention. Disassemble and clean the cartridge. Note the following points upon reassembly:

1. **168 diaphragm should be free of punctures or cuts.**
2. **306 O-ring should be free of flat spots, cuts, etc. and lubricated with one or two drops of lubricant.**
3. **328 O-ring seal should be clean and free of cuts, etc.**

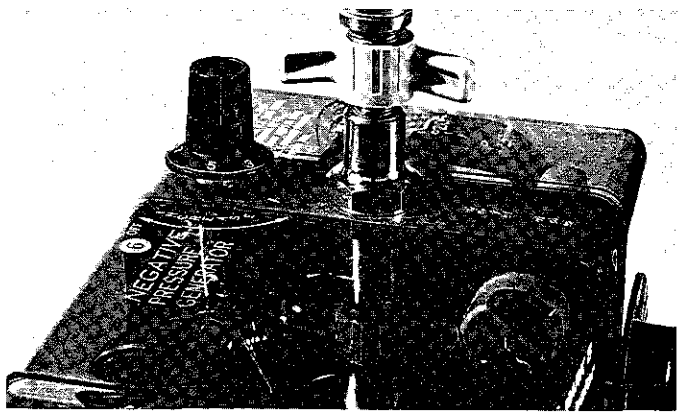


negative generator cartridge 302

The function of the cartridge can be tested after reassembly before installing on center body. Remove end cap if installed and connect small red tubing to appropriate center body outlet. Turn gas supply "on" and manually depress and release diaphragm to interrupt and start flow. Note that red .125 tubing (⅛") is used in the negative phase system and the tubing running to the venturi jet is also red.

Calibration of the control valve:

1. **Install positive/negative breathing head assembly 333 with 409 test lung.**
2. **Set respirator sensitivity control to the red number "5."**
3. **Remove knob from control valve and adjust valve shaft until —3 cm H_2O reads on the respirator manometer.**
4. **Replace valve knob with "3" aligned with the index on the center body and tighten retaining screw.**



the negative pressure generator control knob illustrated with the "3" aligned with the index or the center body.

See bird form L718

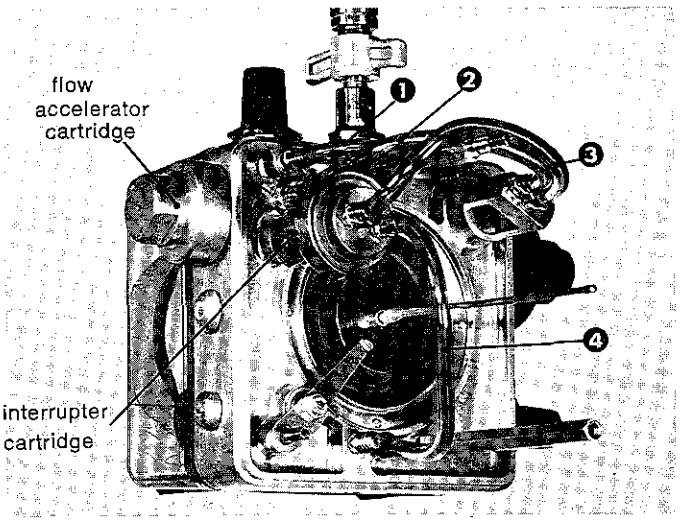
MARK 10 AND MARK 14

respirator/ventilator supplementary instructions

The bird MARK 10 and MARK 14 units are virtually identical in function. They differ from the MARK 7 in that they both incorporate a dual stage inspiratory flow pattern. This is accomplished with the use of two cartridges, a control valve and a special venturi tri-jet. Both units are easily identified by the gold anodized centerbody and markings on the ambient compartment.

The control valve located behind the inlet assembly and labeled "terminal inspiratory flow" meters a small amount of flow to the blue anodized accelerator interrupter cartridge. During the "off" cycle of the respirator, this small flow merely bleeds off to ambient. However, at the start of the inspiratory phase, this flow is diverted to the flow accelerator cartridge located in the back of the centerbody. When this cartridge is pressurized high pressure gas activates the two additional jets in the venturi assembly therefore increasing the flow from the respirator. The control valve adjusts the time from the start of inspiration until the accelerated flow begins, and this should be adjustable from zero seconds to infinity.

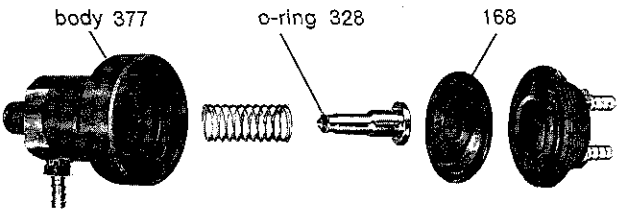
The control valve and the accelerator cartridge are the most critical components of this system. The valve must meter a very small flow of gas and any leak defeats the function of the system. Remove the tubing from the flow accelerating system and determine that the valve has the ability to adjust the amount of flow and is capable of shutting this flow off. The most common problems encountered here are a faulty 114 O-ring or a worn valve needle.If the latter problem is encountered it is best to replace the entire valve assembly.



ambient compartment removed exposing the blue accelerator interrupter cartridge and tubing.

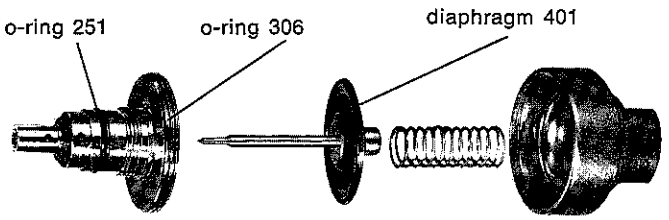
1. top rear centerbody outlet to side outlet of blue cartridge
2. second from top rear centerbody outlet to venturi jet
3. cartridge outlet to venturi jet
4. cartridge outlet to lower centerbody fitting

During the respirator "off" cycle, the flow from the metering valve should bleed out a small hole located in the side of the blue anodized interrupter cartridge. At the start of the inspiratory phase this flow should be diverted to the accelerator cartridge via the centerbody. This may be checked by removing the end cap from the cartridge and manually depressing the diaphragm. This should divert the small leak entirely. Disassemble the cartridge and check the 168 diaphragm for cuts or punctures. Check the 328 O-ring for flat spots, cuts, etc.



accelerator interrupter cartridge 317

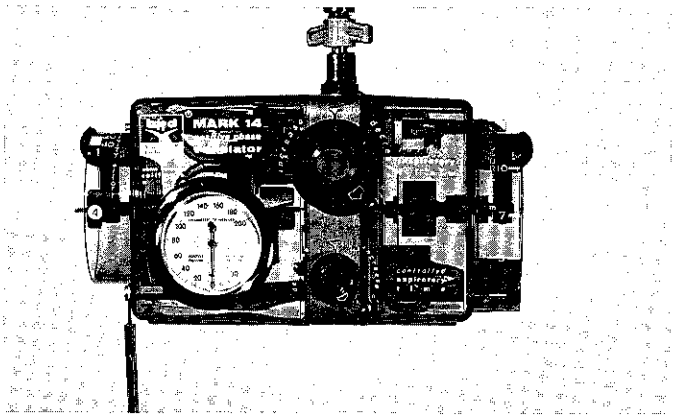
see bird form L723



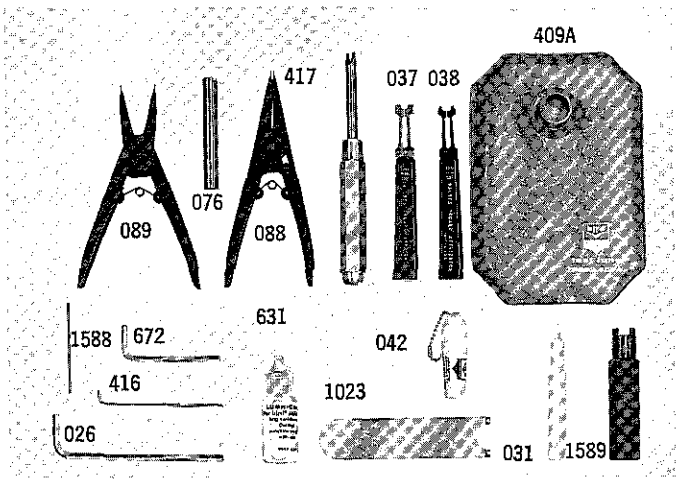
automatic flow accelerator cartridge 250
disassemble by using bird wrench 1023

The gold accelerator cartridge consists basically of a diaphragm activated needle valve. At the start of inspiration, flow from the control valve via the interrupter cartridge begins to act upon the spring loaded diaphragm. When pressure is sufficient to overcome the spring tension, the needle is pulled off its seat and the gas from the respirator inlet source is allowed to flow to the venturi tri-jet. Remove the cartridge from the centerbody using a ¾" open end wrench. Note that there are four (4) O-ring seals on the cartridge, all of which should be free of cuts or flat spots. It is imperative that gas not be allowed to bypass any of these O-rings when the cartridge is installed in the centerbody. Check that the centerbody itself is clean and the O-ring seats are free from nicks or other markings. Disassemble the cartridge using the special 1023 spanner wrench. Check the diaphragm for leaks, the needle shaft for cleanliness and the shaft O-ring seal 306 for competence and lubrication.

After reassembly, calibrate the accelerator system as follows: Remove the valve knob and adjust the valve shaft for an interval of four seconds from the start of inspiration until the accelerated flow begins. Install the knob so that the arrow is aligned with the index on the centerbody.



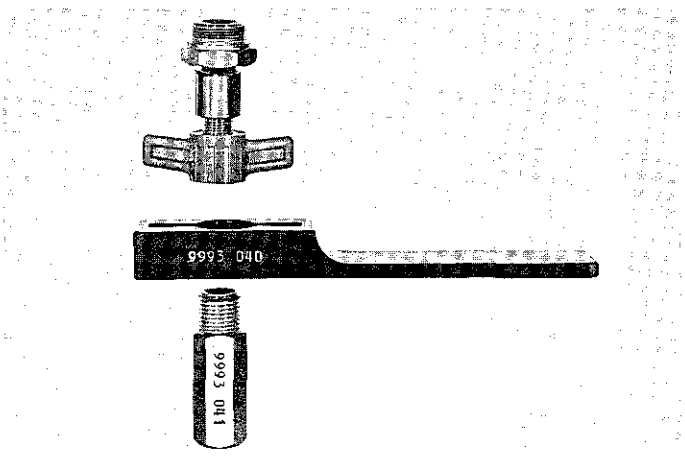
Calibration of the MARK 14 is similar to the MARK 7. Calibrate the pressure control to 15mm Hg, the sensitivity to −2mm Hg and the arrow indexed flowrate knob set in the 4 o'clock position with the flow off. The expiratory time should be 3 seconds with the arrows aligned.



079 Servicemen's tool kit

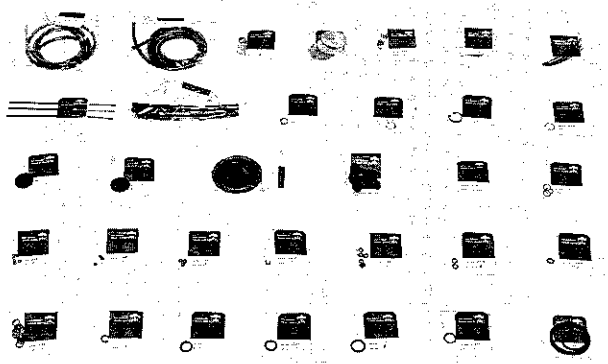
PARTS LIST

026 Allen wrench 3/16"
031 Ceramic bushing tool
037 Truarc applicator 3/16"
038 Truarc applicator 1/4"
042 Special lube-wick for O ring seals
076 Expiratory timer washer tool
088 Truarc pliers #2 for grip rings
089 Truarc pliers #1 for grip rings
409 Test lung
416 Allen wrench 3/32"
417 Slotted screwdriver for adjusting pressure and sensitivity controls
631 Lubricant for O ring seals, compatible with oxygen
672 Allen wrench 5/32"
1023 MARK 10 spanner wrench
1588 Drift pin for timer shaft installation
1589 Compressor valve wrench



418 Wingnut installation tool kit

When the 041 Wingnut mandrel is threaded tightly into the 002 Wingnut the 001A is captured securely so it may be threaded into an assembly and tightened using the 040 Wingnut wrench



2200 Respirator repair kit

The bird respirator repair kit includes a selection of all parts normally required for routine maintenance and emergency repair of the bird MARK 7, 8, 9, 10 and 14 respirators

114 O ring seal , 2 included
123 Atmospheric air filter, 3 included
138 O ring seal for air-mix rod 5/16", 6 included
140 O ring seal for venturi gate 3/4"
141 O ring seal for venturi body 7/8"
143 O ring seal for armature plate bumper 3/8", 2 included.
161 Bowed retaining ring for timer cartridge 1/2"
164 Bowed retaining ring for ceramic spool 5/8"
165 Bowed truarc ring for auto timer cartridge 7/8"
168 Diaphragm for negative pressure generator timer cartridge 1 1/4", 6 included
181 Indicator radial arm, 3 included
186 Diaphragm ring screw 3/32", 12 included
187 O ring seal for pressure compartment
193 O ring seal for timer cartridge body 1/2"
198 Safety wire for timer cartridge, 12 included
224 Tubing for manometer, 3 included
253 Truarc retaining ring 5/16"
257 Packing washer for flow accelerator cartridge 5/16"
296 Gasket for flowrate valve stem 27/64"
298 Wire for hand timer shaft, 12 included
306 O ring seal for negative pressure generator stem 1/4", 3 included
326 O ring seal for timer cartridge gate 3/4", 3 included
328 O ring seal for neg. pres. gen. stem 13/64", 3 included
345 C spring ring clip for manometer tubing, 3 included
346 Hand timer control assembly, 3 included
348 O ring seal for flowrate valve stem 7/16", 3 included
401 Diaphragm for flow accelerator cartridge
557 O ring seal for flowrate valve 3/4"
714 Respirator diaphragm 3 5/16" with retaining ring
1389 Tubing, green .125" x 60"
2128 Tubing, red .125" x 60"

NOTE 631 Lubricant listed under 079 Tool kit should be ordered separately and used to lubricate some O ring seals prior to installation